Journal of the Society of Arts.

FRIDAY, MARCH 20, 1863.

NOTICE TO MEMBERS.

The Index to the first ten volumes of the *Journal* is now being issued to those members who have applied for it. Any other members desiring copies can have them on application to the Secretary.

COMMITTEES OF REFERENCE.

The Chemical Committee met on Friday, the 13th inst., Sir Thomas Phillips, Chairman of the Council, in the chair. The Chairman invited the Committee to suggest subjects in connection with chemistry as applied to manufactures, to which the attention of the Society might advantageously be directed. Various subjects were then put forward by different members of the Committee, in respect of which it appeared desirable that premiums should be offered by the Society, and it was arranged that a circular should be sent to each member of the Committee, inviting further suggestions in relation to the premium list about to be issued by the Society.

SOCIETY OF ARTS EXAMINATIONS, 1863.—NOTICE TO LOCAL BOARDS.

The Previous Examinations by the Local Boards should be held forthwith, so that the Form 2 (see Programme) may be returned by the 1st April.

Any Local Boards expecting to have candidates desiring to be examined in Music, should apply to the Secretary of the Society of Arts without delay, who will furnish them with a form of test to be used at the Previous Examination in that subject, as explained in Par. 111 of the Programme.

THE SOCIETY'S MEMORIAL OF THE PRINCE CONSORT.

The following circular, with an abstract of the proceedings of the General Meeting held on the 7th Feb., has been issued to the members:—

Society of Arts, Adelphi, London, W.C., Feb., 1863.

Sir,—I am directed to bring to your notice the subjoined proceedings of a Special General Meeting of this Society, held on Saturday, the 7th instant.

Should you desire to have your name placed on the list of subscribers, I shall feel obliged by your filling in the accompanying paper, and returning it to me, with your subscription, which may be in the form of a post-office order or cheque, made payable to the Financial Officer, Mr. Samuel Thomas Davenport, and crossed Coutts and Co.

I am, Sir, your obedient servant,

P. LE NEVE FOSTER, *Secretary.*

The subscription of each member is limited to one guinea.

The following is the list of subscribers up to the 19th inst. :—

Abbott, Major-General Sir Frederick, C.B.	£1	1	0
Adams, Thomas	1	1	0
Adams, George G.	1	1	0
Adams, George William	1	1	0
Addington, Right Hon. Henry Unwin	1	1	0
Adley, Charles Coles	1	1	0
Akroyd, Edward	1	1	0
Alger, John	1	1	0
Allen, Thomas	1	1	0
Ames, John	1	1	0
Anderton, James	1	1	0
Andrew, W. P.	1	1	0
Asprey, Charles	1	1	0
Artingstall, George	1	1	0
Atkins, George James	1	1	0
Atkinson, William	1	1	0
Austin, James	1	1	0
Avery, Thomas Charles	1	1	0
Bacon, Jacob Perkins	1	1	0
Bagnall, Charles	1	1	0
Balleras, Guillermo Esteban	1	1	0
Barber, Charles	1	1	0
Barry, Dykes	1	1	0
Bartholomew, C.	1	1	0
Bartlett, William E.	1	1	0
Bateman, J. F.	1	1	0
Baylis, W. Henry	0	10	6
Beckwith, Edward Lonsdale	1	1	0
Belcher, Rear-Admiral Sir Edward	1	1	0
Bell, John	1	1	0
Bentley, Robert J.	1	0	0
Best, Hon. and Rev. Samuel, M.A.	1	1	0
Betts, Edward Ladd	1	1	0
Beyer, Charles F.	1	1	0
Birkett, John	1	1	0
Bischoff, James	1	1	0
Black, Alexander	1	1	0
Blagden, George	1	1	0
Blaine, Delabere Roberton	1	1	0
Bodkin, William Henry	1	1	0
Boileau, Sir John P., Bart., F.R.S	1	1	0
Bonnewell, William Henry	1	1	0
Bosanquet, George Jacob	1	1	0
Bowley, Robert K.	1	1	0
Boyd, James	1	1	0
Braby, Frederick	1	1	0
Brassey, Thomas	1	1	0
Breillat, E.	1	1	0
Bremner, Samuel	1	1	0
Brett, John W.	1	1	0
Brickwood, John Strettell	1	1	0
Bright, Sir Charles	1	1	0
Broad, Robert	1	1	0
Brook, Charles	1	1	0
Brooke, Charles, F.R.S.	1	1	0
Brooke, John	1	1	0
Brookes, William	1	1	0
Brooks, Henry	1	1	0
Browell, Edward M.	1	1	0
Brown, Henry	1	1	0
Brown, Sir William, Bart.	1	1	0
Browne, Edward	1	1	0
Budgett, John P.	1	1	0
Burgoyne, Gen. Sir John F., Bart., G.C.B., F.R.S.	1	1	0
Burton, William S.	1	1	0
Cama, M. H.	1	1	0
Candy, Charles	1	1	0
Caplin, Madame R. A.	1	1	0

Champion, Percival	1	1	0
Chance, Robert Lucas	1	1	0
Charlton, Henry	1	1	0
Chater Joseph	1	1	0
Chester, Harry	1	1	0
Christie, Robert Monro	1	1	0
Clabon, John M.	1	1	0
Clutton, John	1	1	0
Cock, John, Junr.	1	1	0
Coghlan, H. T.	1	1	0
Cohen, Henry Louis	1	1	0
Cole, Henry, C.B.	1	1	0
Colman, Jeremiah James	1	1	0
Cooper, William	1	1	0
Cope, Walter	1	1	0
Corbett, John	1	1	0
Corderry, Edward	1	1	0
Cosens, Frederick W.	1	1	0
Coulson, William	1	1	0
Courtauld, Samuel	1	1	0
Creed, Henry	1	1	0
Critchett, Charles (Assistant Secretary)	1	1	0
Cubitt, William	1	1	0
Cullingford, W. H.	1	1	0
Curling, Joseph	1	1	0
Curtis, William	0	10	6
Crawford, Robert Wygram, M.P.	1	1	0

Darby, Abraham	1	1	0
Davenport, Samuel Thomas (Financial Officer)	1	1	0
Davidson, Thomas	1	1	0
Dawbarn, George	1	1	0
Dawbarn, Richard W.	1	1	0
Dawbarn, Robert	1	1	0
Dawson, Henry	1	1	0
Day, William	1	1	0
Deane, Edward	1	1	0
Debary, Peter Francis	1	1	0
Dickson, Peter, F.R.G.S.	1	0	0
Dilke, Sir C. Wentworth, Bart.	1	1	0
Dilke, Charles W.	1	1	0
Dillon, John	1	1	0
Dines, George	1	1	0
Dix, Thomas	1	1	0
Dixon, Thomas	1	1	0
Docker, F. W.	1	1	0
Dowleans, A. M.	1	1	0
Drax, J. S. W. S. Erle, M.P.	1	1	0
Duncum, Charles	1	1	0
Dunn, Thomas	1	1	0
Dutton, William C.	1	1	0

Eamonson, Joshua J.	1	1	0
Eastham, John	1	1	0
Easton, James	1	1	0
Easton, Percy Shand	1	1	0
Ebury, Lord	1	1	0
Elliot, William Henry Fletcher	1	0	0
Ellis, William	1	1	0
Ethelston, Rev. Charles Wickstead, M.A.	1	1	0
Evans, E. Bickerton	1	1	0
Evans, Jeremiah	1	1	0
Ewart, William M.P.	1	1	0

Faraday, Michael, D.C.L., F.R.S.	1	1	0
Faulkner, John, Junr.	1	1	0
Fauntleroy, Robert Thomas	1	1	0
Field, John	1	1	0
Field, William	1	1	0
Foley, Lord	1	1	0
Fordham, Thomas	1	1	0
Foster, P. Le Neve (Secretary)	1	1	0
Fox, Sir Charles	1	1	0
Fowler, Robert N.	1	1	0
Freer, Rev. Richard Lane, D.D.	1	1	0
Fussell, Alexander	1	1	0

Gadesden, Augustus William	1	1	0
Garling, Henry	1	1	0
Geeves, William	1	1	0
Gibson, Henry	1	1	0
Gilbart, James William, F.R.S.	1	1	0
Goding, Charles	1	1	0
Godwin, George, F.R.S.	1	1	0
Gonzaga, H. S. H. the Prince Alexander of, and Duke of Mantua	1	1	0
Gooch, Joseph H.	1	1	0
Gooch, Thomas	1	1	0
Goode, Thomas	1	1	0
Gordon, Col. W. J., C.B., R.E., D.A.G.	1	1	0
Gould, Charles Augustus	1	1	0
Graham, Peter	1	1	0
Graham, Thomas, D.C.L., F.R.S.	1	1	0
Graham, William	1	1	0
Grant, Alexander	1	1	0
Grey, Major-General the Hon. Charles	1	1	0
Grove, W. R., Q.C., F.R.S.	1	1	0
Gruneisen, Charles Lewis	1	1	0

Hack, Thomas	0	10	6
Haden, F. Seymour, F.R.C.S.	1	1	0
Hall, Walter	1	1	0
Hamilton, Edward	1	1	0
Hamilton, Sir Robert N. C., Bart.	1	1	0
Hammond, William Parker	1	1	0
Hammond, W. Parker	1	1	0
Hancock, James Lyne	1	1	0
Hancock, Frederick William	1	1	0
Hanhart, Michael	1	1	0
Hannay, John	0	10	6
Hannay, Robert	1	1	0
Hannay, Robert, Jun.	0	10	6
Hannay, Thomas	0	10	6
Hannington, C. S.	1	1	0
Harrison, Henry	1	1	0
Harrison, Thomas E., C.E.	1	1	0
Hawes, William	1	1	0
Hawkshaw, John, F.R.S.	1	1	0
Hayward, T. Carlyle, Jun.	0	10	6
Headland, Edward	1	1	0
Heal, John Harris	1	1	0
Heane, Henry	1	1	0
Heather, James	1	1	0
Hereford, the Dean of	1	1	0
Heymann, Lewis	1	1	0
Heywood, James	1	1	0
Hick, John	1	1	0
Hicks, Thomas	1	1	0
Hill, Charles	1	1	0
Hollins, Michael Daintree	1	1	0
Holmes, Alfred William	1	1	0
Holmes, Herbert Mountford	1	1	0
Holmes, James	1	1	0
Hooper, Bartlett	1	1	0
Hooper, George Norgate	1	1	0
Horner, Edward	1	1	0
Horton, Isaac	1	1	0
Horton, John	1	1	0
Howard, Philip Henry	1	1	0
Howard, Thomas	1	1	0

Imhof, Daniel	1	1	0

Jackson, Richard M.	1	1	0
James, Jabez	1	1	0
James, Jabus Stanley	1	1	0
Jellicoe, Charles	1	1	0
Jewesbury, H. W.	1	1	0
Joel, Joseph	1	1	0
Johnson, Henry	1	1	0
Johnson, Jabez	1	1	0
Jones, James W.	1	1	0
Jones, Owen	1	1	0

Jones, Richard Lambert	1	1	0
Keeling, Herbert Howard	1	1	0
Kelk, John	1	1	0
Kemp, George T.	1	1	0
Khaznadar, S. E. le Général Moustapha, Premier Ministre de S.M. Tunisienne	1	1	0
Lacy, Henry Charles	1	1	0
Lambert, Thomas	1	1	0
Larnach, Donald	1	1	0
Lavanchy. John R.	1	1	0
Lawrence, Frederick	1	1	0
Le Couteur, Col. John, F.R.S	1	1	0
Leeks, Edward Frederick	1	1	0
Leighton, John, F.S.A.	1	1	0
Levi, Leone	1	1	0
Lewis, Stephen W.	1	1	0
Linnington, A. H.	1	1	0
Longstaff, G. Dixon, M.D.	1	1	0
Lovegrove, James Samuel	1	1	0
Lovegrove, Samuel	1	1	0
Lowe, George, F.R.S.	1	1	0
Lucas, Thomas	1	1	0
Macarthur, Major-Gen. Sir Edward, K.C.B.	1	1	0
MacDonald, J. C.	1	1	0
Macfarlane, Walter	1	1	0
Mackrell, W. T.	1	1	0
Maclaran, George	1	1	0
Maclea, Charles G.	1	1	0
Malcolm, Major-Gen. G. A.	1	1	0
Manby, Charles, F.R.S.	1	1	0
Marryatt, Joseph	1	1	0
Marsh, Matthew Henry, M.P.	1	1	0
Martin, John	1	1	0
Martin, Thomas	1	1	0
Martineau, David	1	1	0
Martyn, Silas Edward	0	10	6
Matthew, James	1	1	0
May, Harry	1	1	0
Mayor, Right Hon. the Lord	1	1	0
McMurray, William	1	1	0
Mechi, Alderman	1	1	0
Merle, William Henry	1	1	0
Metchin, W. P.	1	1	0
Middleton, David	1	1	0
Miles, Alfred W.	1	1	0
Mocatta, Benjamin	1	1	0
Moore, Charles	0	10	6
Morant, Robert	1	1	0
Moule, John	1	1	0
Moulton, Stephen	1	1	0
Muir, William	0	10	6
Mulready, William, R.A.	1	1	0
Munn, Major W. A.	1	1	0
Murchison, J. H.	1	1	0
Murchison, Sir Roderick Impey, K.C.B., D.C.L.	1	1	0
Napier, Robert	1	1	0
Navroji, Dádábhái	1	1	0
Newcombe, S. Prout	1	1	0
Noble, Matthew	1	1	0
Oastler, Jonah	1	1	0
Oldershaw, Capt.	1	1	0
Owen, Professor Richard, F.R.S.	1	1	0
Pagden, Stephen	0	10	6
Pakington, Sir John S., Bart., M.P.	1	1	0
Palmer, George	1	1	0
Paul, J. Michell	1	1	0
Pearce, Alfred B.	1	1	0
Penn, John	1	1	0
Petrie, Samuel	1	1	0
Pierce, William	1	1	0
Phelps, Charles	1	1	0
Phillips, Sir Thomas, F.G.S.	1	1	0
Pitts, Samuel	1	1	0
Platt, John	1	1	0
Potter, Thomas	1	1	0
Preller, C. A.	1	1	0
Price, Arthur J.	1	1	0
Proctor, John	1	1	0
Provis, William Alexander	1	1	0
Pryor, William S.	1	1	0
Quain, Richard, M.D.	1	1	0
Radstock, Lord	1	1	0
Ratcliff, Charles	1	1	0
Rawlinson, Robert	1	1	0
Rawson, W. H. Jun.	1	1	0
Redgrave, Samuel	1	1	0
Reeve, Charles	1	1	0
Reeves, John Russell, F.R.S.	1	1	0
Reid, Lestock Robert	1	1	0
Reiss, James	1	1	0
Rennie, Sir John, F.R.S.	1	1	0
Reveley, Henry W	0	10	0
Rivett, Joseph Cedric	1	1	0
Rixon, Alfred H.	1	1	0
Robb, Alexander	1	1	0
Roberts, Henry, F.S.A.	1	0	0
Rodocanachi, M. E.	1	1	0
Routledge, Thomas	1	1	0
Russell, Capt. G.	0	10	0
Russell, John	1	1	0
Russell, John James	1	1	0
Russell, John Scott, F.R.S.	1	1	0
St. David's, Bishop of	1	1	0
Salomons, Aaron	1	1	0
Salomons, David	1	1	0
Salt, Titus	1	1	0
Sargood, F. J.	1	1	0
Saul, G. T.	1	1	0
Schneider, Richard	1	1	0
Sedgwick, John Bell	1	1	0
Shearer, Betteswoth Pitt	1	1	0
Sheriff, G. W.	1	1	0
Shove, W. Spencer	1	1	0
Sibthorp, Henry, A. M. W.	1	1	0
Sich, Henry	1	1	0
Silverlock, H.	1	1	0
Simon, George	1	1	0
Simpson, William Butler	1	1	0
Skey, Joseph, M.D.	1	1	0
Smart, Sir George T.	1	1	0
Smith, George	1	1	0
Smith, George	1	1	0
Smith, J. Scott	1	1	0
Smith, R. M.	1	1	0
Smith, T. Mosdell	1	1	0
Sopwith, Thomas, F.R.S.	1	1	0
Spark, Henry King	1	1	0
Spicer, Henry	1	1	0
Spicer, William Revel	1	1	0
Stanton, George	1	1	0
Stephens, Charles	1	1	0
Stephens, Henry	1	1	0
Stirling, Thomas	1	1	0
Stohwasser, Joseph	0	10	6
Straker, John	1	1	0
Styles, Thomas	1	1	0
Sugden, Samuel	1	1	0
Sulivan, Right Hon. Lawrence	1	1	0
Symonds, Capt. R.N.	1	1	0
Sykes, Col. W. H., M.P., F.R.S.	1	1	0
Taylor, George	1	1	0
Taylor, John	1	1	0

Teulon, Seymour	1	1	0
Thomas, John Evan, F.S.A.	1	1	0
Tooke, William, F.R.S. (President of the Society)	1	1	0
Trevelyan, Arthur	1	1	0
Trevelyan, Sir Walter Calverley, Bart.	1	1	0
Trower, G. S.	1	1	0
Tuely, Nathaniel C.	1	1	0
Tueski, Moritz Paul	1	1	0
Tulloch, James	1	1	0
Turner, W. Shearman	1	1	0
Twining, Thomas	1	1	0
Underdown, E. M.	1	1	0
Unwin, George	0	10	0
Vandoni, Le Commandeur Comte de	1	1	0
Vane, Rev. John	1	1	0
Varley, Cornelius	0	10	6
Veitch, James	1	1	0
Vieweg, A. J.	1	1	0
Walker, Sir Edward S.	1	1	0
Wass, C. Wentworth	0	10	6
Watkins, Zachariah	1	1	0
Watney, Norman	1	1	0
Watson, Dr. J. Forbes, M.A.	1	1	0
Watson, Thomas	1	1	0
Webb, Charles Locock	1	1	0
Webb, Henry Bellamy	1	1	0
Webb, John	1	1	0
Webber, Henry	1	1	0
Whetham, Charles	1	1	0
White, H. C.	1	1	0
Whitfeld, Henry	1	0	0
Willich, C. M.	1	1	0
Williams, Charles Wye	1	1	0
Williams, R.	1	1	0
Williams, Walter	1	1	0
Williams, William	1	1	0
Wilson, G. Fergusson, F.R.S.	1	1	0
Wilson, W. Newton	1	1	0
Winkworth, Thomas	1	1	0
Woodd, Basil Thomas, M.P.	1	1	0
Wood, John	1	1	0
Wood, Vice-Chancellor Sir W. Page	1	1	0
Woodhouse, John Thomas	1	1	0
Woollams, Henry	1	1	0
Woolloton, Charles	1	1	0
Wright, Philip	1	1	0
Wyon, Joseph Shepherd	1	1	0
Wyon, Leonard C.	1	1	0
Yeats, John, LL.D., F.R.G.S.	1	1	0
Zaehnsdorf, Joseph	0	10	6
Zetland the Earl of	1	1	0

FIFTEENTH ORDINARY MEETING.

WEDNESDAY, MARCH 18, 1863.

The Fifteenth Ordinary Meeting of the One Hundred and Ninth Session was held on Wednesday, the 18th inst., Thomson Hankey, Esq., M.P., in the chair.

The following candidates were proposed for election as members of the Society:—

Beech, Thomas	6, Russell-place, Old Kent-road, S.E.
Beevor, Charles	41, Upper Harley-street, W.
Bell, Alexander	18, Harrington-square, N.W.
Carpenter, William	8, Brunswick-square, W.C.
Perkins, George	Clipsted-place, Sevenoaks.

The following Candidates were balloted for and duly elected members of the Society:—

Allen, J.	81, Stainsby-road, East India-road, E.
Allum, Edwyn	43, Kensington-square, W.
Anderdon, James Hughes.	23, Upper Grosvenor-st., W.
Arber, Edward, A.K.C.	Admiralty, Somerset House, W.C.
Baccani, Attilio	1A, Cranley-terrace, Brompton, S.W.
Bailey, John	10, Conduit-street East, Paddington, W.
Banister, John	13, South-st., Finsbury, E.C.
Chadburn, Charles Henry.	71, Lord-street, Liverpool.
Grattann, William Henry.	1, Belmont-villas, Kensington, W.
Kerrison, Sir Edward C., Bart., M.P.	140, Piccadilly, W.
Lovegrove, John James.	6, Pembroke-place, Spring-grove, Isleworth, W.

The SECRETARY drew attention to an instrument for sounding alarum in case of fire, or regulating ventilation in accordance with the temperature of the apartment. See page 318.

The Paper read was—

ON THE SUPPRESSION AND EXTINCTION OF FIRES.

BY CHARLES B. KING, M.E.

The subject upon which I have the honour to address this Society is one of great importance, and one which has been considerably overlooked. In large manufacturing towns and cities, where immense wealth, in the shape of merchandise, is closely packed and stored, the importance of an improved construction of fire-proof warehouses cannot be over rated. Again, in a densely populated district, should there not be as much attention directed towards the safety of human lives from the fearful ravages of the devastating element, as from the ordinary diseases and infections arising from defective sewage and ventilation. These are questions I find no difficulty in answering; the remedy I apprehend rests with the public themselves (who are really the interested parties), by raising unanimously their voice of appeal to the government, and it is the object of the present paper to give, in a succinct form, a few facts collected from practical experience.

The first section of my paper, as its title implies, will be directed to a consideration of means tending to the suppression of fires, and on this point it will be found that carefulness, which is a remedy for all existing evils, is also the main one tending to a suppression of fires; the careless handling of open lights, lucifer-matches, children playing with fire, reading in bed, airing linen before a fire, improper gas fitting, raking out a fire at night before retiring to rest, are all of them common and prolific sources from which fires arise; and sources, too, that a little care and attention may prevent. The lagging of steam-pipes often becomes red-hot, and, dropping off, ignites any timber that may be near. A very serious item of loss is caused by linendrapers and other dealers in textile fabrics removing their goods from their shop windows with the gas burning, flues taking fire, the use of explosive oils in lamps, and many others could be added to the foregoing list of fires caused by thoughtlessness. A remedy for this might be found by masters at short intervals minutely examining their premises and stock, and strongly enforcing the obedience of a code of rules specially adapted to each particular case.

It was urged by the late Mr. James Braidwood, Superintendent of the London Fire Engine Establishment (in an admirable paper read before your Society, on May 7th, 1856), that an official inquiry into the causes of fires would be one of the greatest preventives of the carelessness above alluded to, as it would not only show the faults that had been committed, and thus warn others, but the idea of being publicly exposed in the press would be an additional

incentive to carefulness. Mr. Payne, the coroner, some years ago, held inquests on fires that occurred in the City, but as the authorities would not allow him his expenses, these inquiries were discontinued, although believed to be of considerable service in explaining accidental and other causes of fire.

Buildings cannot be made wholly fire-proof, but they can be constructed with a view of rendering them impervious to fire, viz., to resist, not assist, any fire that may break out upon their floors. Many architects and other persons of position have from time to time turned their attention to this subject, and a large number of patents have been the result of their deliberations. It would be needless to go through the list of these, so I shall draw your attention to the model mill at Saltaire, belonging to Messrs. Titus Salt, Sons, and Co., which has been constructed fire-proof throughout. The floors, as you will see by reference to the diagram on the wall, are composed of longitudinal cast-iron girders, from the bottom flange of which a brick arching is sprung; this is bound together transversely by tie-rods on the top of the arching; to form the floors flagstones are laid, between which and the arch a layer of concrete is placed.

Another description of fire-proof buildings are those in which a water service is laid on, ready to subdue any fire that may occur. To illustrate this I will briefly draw your attention to a plan proposed and patented by Mr. Joseph Beattie, Locomotive Superintendent of the London and South-Western Railway Company, and applied by him to the railway workshops at Nine Elms; his plan being as follows:—He places in the brick-work, or other materials of which the main building is composed, one or more cast-iron main pipes from the basement or ground-floor to the roof or other part of the building, as may be required, and has branch pipes from each main pipe into each floor, and, if required, into each room, and carries such branch pipes round the ceiling; these are perforated, and have ornamental mouths or roses. There are also suitable joints or cocks, so that when a fire has broken out in any room or corner of a room, the water can be forced by steam or other power from below, through the main pipe, from thence through the branches into the rooms, as required, for the extinction of the fire. With these examples I shall close this section of my paper, and pass on to the more important one of considering the means of extinguishing fires.

Water is usually regarded as the "antagonistic element" to fire, and properly so, for although any fluid that will cut off the supply of oxygen essential to the support of combustion, will put out fire, water, from its cheapness and abundance, must always be the pre-eminent fire extinguisher. Many plans have been proposed for increasing the extinguishing power of water; acids, alkalies, neutral salts, and even clay have been successfully employed, but the difference in the extinguishing effect is so small as to be wholly unworthy of consideraon; in short, all such schemes are practically useless. Captain Manby, fifty years ago, advocated the use of an alkaline solution, projected from portable pneumatic fountains. A gentleman has very recently taken out a patent for a fire-extinguishing apparatus, in which water, charged with carbonic acid gas, is applied in a manner similar to Captain Manby's. Phillips' Fire Annihilator was invented a few years back, and is useful in contending with a fire in its earliest stages; beyond this, when tried, it has been practically found to fail.

The mode of applying water to extinguish fires received a great advance upon the introduction of leather hose by the brothers Van der Heide, at Amsterdam, in 1672. This contrivance enabled the stream of water to be conveyed a considerable distance from the engine, and directed upon the flames with great precision and effect. The practice first introduced by these Dutch firemen was that which the late Mr. Superintendent Braidwood so strongly inculcated upon all persons having charge of fire-engines. Up to the latter end of the last century, the mode of supplying water to fire-engines was principally by pouring it into the cistern from buckets, or from a fire-cock or standpipe; but as the engines became more numerous and competition increased, the engrossment of the water supply was not permitted; a plug being drawn the water ran free, and was collected in dams, made by breaking up the paving of the roadway, from whence the water was drawn through the suction pipe. The great improvements in the construction of engines and their appurtenances, especially the introduction by Simpkin, in 1792, of metallic valves instead of leather, permitted the use of suction pipes with advantage. In 1820, Mr. William Baddeley proposed to do away with the breaking-up of the roadway, a difficult and tedious operation, by placing a portable *canvas dam* or cistern over the plug hole, which collected a quantity of water for the supply of the engines without any trouble or loss of time. The prejudices of the firemen, however, were for a long time insurmountable, and it was not until the year 1836 that Mr. Baddeley's plan came into general use. In 1838 Mr. Baddeley received the silver medal of the Society of Arts for his invention (which is described in the Society's Transactions *), and his portable cisterns are now universally adopted.

In some experiments instituted by M. Von Marum, he found that water, directed upon a fire in its early stages, or when burning over an extended surface, and not in a mass, was most effective in the form of spray, and that a small quantity of water, so applied, sufficed to extinguish a very large burning surface. For the practical application of this principle we are likewise indebted to Mr. Baddeley, for he introduced a jet-spreader which could be attached to the ordinary branch nozzles, and brought into action by the pressure of the thumb on a small lever. The jet not being acted upon until it had left the nozzle, choking never took place, which was always the case when perforated nozzles were employed. This spreader has been found invaluable at agricultural fires, and is used with great advantage in horticultural engines. It is now pretty generally understood that large fires are unextinguishable; by some persons it is thought that water thrown upon them becomes decomposed and adds to the fury of the fire. It has not yet, however, been satisfactorily shown that any such effect takes place; but it is certain that the water is some way or other disintegrated without producing the least effect upon a furiously burning mass. This is particularly noticeable when a stream of water is directed over and into a lofty burning building of which the roof has fallen in, the divided state of the jet enabling it to be readily dispersed by the ascending column of heated air. The only chance of successfully coping with such a fire, is by attacking it at a low level, whence, either ascending or descending, the water may act beneficially. From the great apparent difficulty of successfully dealing with large fires, it is manifest that those plans will be most advantageous that can be applied at the commencement of a fire, and for this purpose the ordinary hand-pump cannot be surpassed. The great success which has attended its use both by firemen and civilians is, in many well-authenticated instances, truly marvellous. Many fires which, upon their first discovery, might have been covered by a hat, for want of such apparatus as a hand pump and a bucket of water, have grown into extensive conflagrations, entailing in many instances the loss of much valuable property.

The importance of receiving speedy information of the outbreak of a fire induced me to design a fire observatory, upon submitting which to Mr. Hodges, he immediately instructed me to erect one on his extensive premises, which has been executed, and was opened for work last August. It is constructed wholly of cast and wrought iron, the main mast being of wrought iron; its height is 135 feet, the diameter at top being 12 inches and at bottom 21 inches. It is passed through the building and bolted to

* Transactions, vol. 52, page 88.

a large wrought iron foundation plate at bottom; this fastening, together with wire rope shrouding and its own weight, relieve the building (which is a very old one) of any severe shock or strain from its oscillation in a heavy gale of wind. The means of ascent to the platform above are from the outside; the watchman steps into a cage (from which he cannot accidentally fall), and pulls on two rods run down the outside, holding the cage by lugs at the bottom; a chain is attached to the cage, which, in its turn, runs over a rigger and is fastened to a counter-balance weight running down the inside of the mast. Since its erection it has been on several occasions most useful in detecting the precise neighbourhood of a fire, and enabling Mr. Hodges' fire brigade to be first on the scene of disaster. It is proposed eventually to connect this observatory with neighbouring fire-engine stations by telegraph, so that an almost instantaneous turn-out of engines may be made on the discovery of a fire. The best means of arresting fires is a very wide question, as the only limit to the means is the expense. On the continent, generally, the whole is managed by government, and the firemen are placed under martial law, the inhabitants being compelled to work the engines. In London, the principal means is a voluntary association of the insurance companies, without legal authority of any sort, the legal protection by parish engines being, saving a few praiseworthy exceptions, a dead letter. Volunteer aid is also given in London, and several large establishments maintain fire brigades of their own. The foremost of these is unquestionably that belonging to the Lambeth Distillery, which is under the immediate personal superintendence of Mr. Frederick Hodges, who has devoted himself with extraordinary and unwonted energy to this subject. Then there is the True Blue Fire Brigade at Millwall, commanded by Mr. William Roberts, together with those belonging to Beaufoy's Distillery, Reid's Brewery, Price's Patent Candle Company, and the Notting-hill Fire Brigade, under Mr. Durnford; the Dock Companies also maintain Fire Brigades. In Liverpool, Manchester, Leeds, and other towns and cities, the extinction of fires by the pressure of water only, without the aid of fire-engines, is very much practised, and is found to be efficient and very economical, the pressure on the mains varying from 80 to 120 lbs. on the square inch, which is sufficient for all practical purposes to throw a jet over the highest of their buildings. The advantages of this high-pressure system are obvious, but to enable it to be universally adopted in London the whole water supply would require to be remodelled. In America the firemen are generally volunteers, enrolled by local government. They are exempt from military duty and service on juries, which appears to satisfy them, as the situation of fireman is eagerly sought in most of the American cities. It would be difficult to say which of these various systems is best; probably each is best suited to the place where it exists.

The deficient arrangements existing in London have for a long time been manifest. In the last session of Parliament the question was made the subject of official inquiry, when various witnesses were examined, the majority of whom were in favour of the Fire-Engine Establishment being combined with the police. However, her Majesty's Government intend shortly to submit a Bill for largely extending the present arrangements to the consideration of Parliament.

The London Fire-Engine Establishment comprises thirty-nine hand-worked engines, one hundred and forty men, four land and two floating steam fire-engines. The manual engines, as you are doubtless aware, are drawn by horses to fires, where they are worked by men who receive one shilling for the first hour, or part of an hour, and sixpence for each subsequent hour, together with an "allowance" of a pint of beer per hour. This makes the working of fire-engines a favourite occupation with the "roughs," who can always be found in the street ready for an odd job. This arrangement relieves the London Fire Engine Establishment from the necessity of maintaining a permanent, large, and expensive force for the work in question. The whole police of the metropolis may likewise be said to be in the pay of the brigade. The policeman who, by the help of his feet and lungs, signals the approach of an engine, and clears the way, is sure of his five shillings; and a sovereign is ready for another policeman who, on the arrival of the engines at a fire, is found upon the spot guarding the door, and protecting the property endangered. In New York, a city which, although of but little more than one-third the size of the metropolis, has our full annual number of fires, the "fire department" numbers about 50 engines, and 4,500 volunteers, regularly organised. If we take, therefore, say 3,500 as the number of men which would be required to work the fire-apparatus of London as it should be, we can easily calculate what the maintenance of such a force would cost, unless, as in New York, we could command gratuitous assistance. In New York, however, the insurance companies have nothing whatever to do with the fire-engines, which belong to the city and are under the management of the municipal authorities. It must be borne in mind, however, that the London Fire Engine Establishment make no distinction, on an alarm of fire, between insured and uninsured property. It is adopted, as a maxim, that the insurance companies cannot afford to permit any fire to spread within the whole circle of their operations, and the freeholder who insures in Manchester, or in Edinburgh, as well as he who neglects to insure at all, alike enjoy the protection of the London offices in respect of the most strenuous efforts to preserve their property from destruction by fire.

In extinguishing fires of any magnitude the steam fire engine must ever hold the foremost place, not only on account of the development of power, but on the more important score of economy. A great check to their adoption and improvement in this country was the opposition so many years maintained by the London Fire Engine Establishment, acting under the advice of the late Mr. Braidwood, who subsequently became a warm advocate of steam fire engines.

The first steam fire-engine was constructed in England by Mr. John Braithwaite, in the year 1830; it was worked at the burning of the Argyll Rooms, the English Opera House, and several other large fires. It consisted of a 6-horse power steam-engine, and the pumps worked thereby, which were swung upon a carriage drawn by two horses. Steam sufficient for working could be obtained in the course of thirteen minutes. This engine particularly distinguished itself at the conflagration at Messrs. Barclay, Perkins and Co.'s brewery, for, after the fire, and the total loss of the steam-engine and pumping apparatus of the establishment, it rendered considerable service to the proprietors of the brewery in pumping for twenty-five days the beer brewed in the part of the building that was saved, to the vats, 50 feet above the level of the street. As the pump was 6½ inches diameter, and made 30·14 strokes per minute, it could pump in a day of ten hours 8,640 cubic feet, and in 25 days, 216,000 cubic feet of liquor to the height of 50 feet. Subsequently, Messrs. Braithwaite and Co. built three engines, one called the "Comet," for the Prussian Ministry of the Interior, which is still in existence at Berlin.

The Americans then took up the subject, and Captain Ericsson, an English engineer, obtained the gold medal offered in 1840 by the New York Mechanics' Institute, "For the best plan of a steam fire-engine," which was very similar to the engines of Mr. Braithwaite. Soon after this Mr. Paul R. Hodge built a steam fire engine in New York designed for auxiliary steam propulsion. About 1850, Mr. A. B. Latta, of Cincinnatti, U.S., constructed an engine, with self propelling gear, weighing 10 tons, which was guided, and in difficult places helped forward, by a pair of horses, their use being advocated on the ground that a machine running alone had a tendency to frighten other horses. Within a few years steam fire engines have

been adopted in Philadelphia, Boston, New York, Baltimore, and other cities of the United States; builders having variously and widely modified the earlier plans, whilst some have made entirely new ones. The main feature of all these plans is the boiler, which is constructed for the rapid generation of steam, and marvellous results have been obtained. Mr. Latta's engines have begun work in from three to five minutes from the application of the match. The engines built by the Amos Keag Company, of Manchester, New Hampshire, have begun in three and a-half minutes. Those of Messrs. Silsby, Mynderse, and Company, Seneca Falls, New York, have begun in five or six minutes. These differences are doubtless due to the varied amounts of heating surface each boiler presents. The engines of Messrs. Lee and Larned, of the Novelty Works, New York, are probably the most celebrated, and with good cause, as being remarkable for their strength, durability, and lightness, all being leading essentials in a successful fire engine. In these engines there is less water to heat, and their flues are extremely light, the grates are smaller than those of the Amos Keag engines, so that the time to make an effective fire is consequently greater, which is no very serious objection. The "Minnehaha" engine (of this make) has $201\frac{1}{2}$ square feet of heating surface, having 199 tubes of $1\frac{1}{4}$ inch diameter, and $\frac{1}{16}$th of an inch thick. The most celebrated engine of this make is that known as the "J. C. Cary." It is fitted with Mr. J. K. Fisher's steam-carriage apparatus, to enable it to be self-propelling. The boiler contains 114 pairs of vertical tubes, arranged annularly, or one within the other, the outer of $2\frac{1}{2}$ inch, and the inner $1\frac{1}{4}$ inch diameter, the annular space between the two being occupied by water. The steam cylinders are $7\frac{1}{2}$ inches diameter and 14 inches stroke. The connecting rods from the engines act on cranks placed upon an intermediate shaft, revolving in fixed bearings upon the frame, and operating the pump, which is one of Cary's patent rotary force pumps of the largest size; the total weight is about eight tons; the length of the frame or body is about $14\frac{1}{2}$ feet, its breadth 7 feet, and the total length of carriage $20\frac{1}{2}$ feet. Sufficient fuel for two hours consumption can be carried on the foot plate at the back of the hinder axle. Steam can be raised to working pressure in from six to ten minutes, but it is intended that steam shall be kept up at all times, so that the engine can start at a moment's notice, which can be done at a comparatively trifling cost. At a public trial on the 5th November, 1858, before Commissioner Cooper and other officials, it threw from 700 to 750 gallons of water per minute through a $1\frac{5}{8}$ inch nozzle a horizontal distance of 252 feet, and a vertical height of 160 feet.

Messrs. Shand and Mason, of Blackfriars, were the first to renew the manufacture of steam fire-engines in this country. Their first engine was constructed in 1858 for the Russian Government. A description of a public trial of this appeared in the *Times* newspaper of October 25th, 1858. Steam was generated to a working pressure in ten minutes from the application of the match and threw jets to a considerable elevation. The engine is now in use in St. Petersburgh. The second engine was tried at Waterloo-bridge Wharf, on the 1st July, 1859; a description of it appeared in the *Times* of July 2nd, 1859. Steam was generated to a pressure of 10lbs. in six minutes. An inch jet was thrown 90 feet vertically, and 130 feet horizontally. The third that was made was somewhat cumbrous, but was successful in working, which encouraged its makers to build another. Accordingly one was made, and purchased by the London Fire Engine establishment for their station in Watling-street. The boiler is a vertical one of peculiar construction, with a copper fire box, and Lowmoor shell plates of one quarter-inch in thickness; there are 199 tubes in the boiler, each 16 inches long by one inch in diameter, the boiler presenting a heating surface of 91·467 square feet. The cylinders are placed horizontally, the piston-rods being connected by a cross-head slotted to admit of the crank being actuated by its pin moving in the slide brasses. The steam cylinder is $8\frac{1}{2}$ inches diameter, and the pump cylinder 7 inches with a stroke of 9 inches. Steam can be raised to the ordinary working pressure (viz. 80 lbs. on the square inch), in 15 minutes from cold water. The weight, including water, fuel, and hose, is 6,500 lbs. Messrs. Shand and Mason have constructed three steam fire-engines for the London and North Western Railway Company, of the same dimensions as the last mentioned, but erected on an independent sole plate; they also constructed one similar to these (but fitted of course to a common road carriage), for the London Fire Engine Establishment. These makers took out a patent for a steam fire-engine. It consists of an upright conical steam generator, or boiler, formed simply of an external cone with an annular space between. The internal cone forms both fire-box and chimney. The hinder axle of the carriage is passed through the boiler by fixing a horizontal annular tube through the body of the boiler in a suitable position, the tube forming a water space in connection with the annular water space of the boiler. There are two single acting steam cylinders, and two single acting pump cylinders connected by tie-rods; the steam and water cylinders are cast in one piece. Messrs. Shand and Mason have made three of these engines, but in practice, owing to their mechanical design and construction, they are continually breaking down either at the crank-shaft or the plates of the boiler forming the top of the fire-box burn away, owing to there being no water circulation round them. The weight is very unequally distributed over the wheels, making the stern of the engine hang heavy. In consequence of the employment of a crank motion, these engines cannot be worked below a certain speed, owing to the difficulty of getting the crank over the centres.

Messrs. Merryweather and Son are now manufacturing steam fire-engines, and they have succeeded in bringing out two very good serviceable engines, named the "Deluge" and the "Torrent." The former of these consists of a vertical boiler, with a quantity of vertical copper tubes. The steam-chest at the top of the boiler is fitted with wrought-iron tubes for carrying off the smoke and creating a draught. Over the fire-box are a series of hanging tubes in which a perfect circulation of water is carried on. There is also an outer water jacket. The boiler is fed with one of Giffard's injectors. Steam is taken from four points, and supplied direct through the valve-chest into the cylinder, in its way passing under the cylinder. The steam cylinder is 9 inches in diameter, and 15 inches stroke; no fly-wheel is used, and by the valve arragement a uniform speed is obtained; this is a great advantage, as the pump is worked steadily, and an even column of water is delivered. The engine can be started, at any point, by opening the steam-valve, and can run at any required speed—a great desideratum in fire duty. The piston-rod is coupled to that of the pump direct, and the two guide-rods connect the pump and steam cylinder together. The pump employed is De la Hire's double acting, but the valves are placed in easily accessible chambers beneath the pump barrel. Provision is also made for completely emptying the barrel at every stroke, thus getting rid of all grit and impurities brought up through the suction. The piston is so constructed as to contain a quantity of oil, which continually lubricates the cylinder at every stroke. Air is contained in a sphere of elastic rubber within the air vessel, which prevents its total absorption. The internal diameter of the suction-pipe is five inches; the internal diameter of each of the two delivery-pipes is three inches. The weight of this engine with running gear complete is three and a-half tons. Steam can be raised from cold water to a pressure of forty pounds on the square inch in ten minutes from the application of the match. It has drawn water through the suction pipe vertically a distance of fourteen feet, and then discharged it over a building sixty feet high to a distance 210 feet through an inch and a-quarter nozzle. The

engine named the "Torrent," by the same makers, differs in a few details, and can be easily drawn by one horse. The steam cylinder is 6½ inches diameter, with a 12-inch stroke. The pump is double acting, the same as used in the "Deluge," is 4¾ inches diameter, with a stroke of 12 inches; the two piston-rods being coupled directly, air-vessels are placed both on the suction side as well as on the deliveries. At a recent trial, cold water being used, a pressure of 37 lbs. of steam was raised in 8 minutes, and 100 lbs. in 9½ minutes from the time of applying the match, and it is capable of discharging 250 gallons of water per minute to a height of 160 feet.

Mr. William Roberts, of Millwall, has constructed a very useful steam fire-engine, which can also be used as a hoist. The engine is 12 feet 6 inches long, by 6 feet 4 inches broad; the steam cylinders, two in number, are 6 inches diameter by 12 inches stroke, placed immediately in front of the boiler and over the shaft. The driving-wheels are 5 feet diameter, and each wheel has two springs, all being within the framing. The moving power is transmitted to the wheels from the main shaft by a pitch chain gearing, 4 to 1; either wheel can be thrown in or out of gear at pleasure by means of a clutch. The steering-wheel is 3 feet diameter, and will lock quite round, enabling the engine to turn completely round in its own length. The pumps are two of Mr. Roberts's Patent, 9½ inches diameter, with a stroke of 8 inches each pump, and they can be very readily connected to the engine or thrown out of gear. The boiler is Benson's Patent, with water tubes, and forced circulation. The engine will carry 60 gallons of water in the tanks, 5 cwts. of coal, 24 feet of ladder (4 feet 6 inches in lengths), 12 feet of suction hose (24 feet if wanted), 40 feet of 4-inch delivery hose, and 450 feet of 2½ inch ditto, 1 large and 4 small branch pipes, 12 buckets, and all the necessary tools, &c., the weight complete being 7 tons 15 cwts. On the end of the main shaft is a rigger, 2 feet in diameter, and a small windlass end to enable it to be used for driving machinery, hoisting, &c., and these are included in the weight of 7¾ tons. Steam can be fairly got up to 140 lbs. per inch in 19 minutes 25 seconds, with all coal, no wood being used except to light the fire in the first instance. With a 1½-inch jet it has thrown the water a distance of 186 feet, and with a 1⅜-inch jet a height of 140 feet; it is fitted with a regulator, so that it can be made to deliver the smallest quantity; with a jet $\frac{1}{64}$th of an inch it took 12 minutes 45 seconds to fill a quart measure. It can be made to use 2, 3, or 4 small jets instead of one large one when desirable to do so, and will deliver 450 gallons per minute. It has been propelled at a rate equal to 18 miles an hour, and has been taken through the High-street, Poplar, at from 12 to 14 miles an hour; it has ascended inclines of 1 in 14 with the greatest ease, stopping in the middle and starting again without difficulty. It has also been run over fresh Macadam road, and upon one occasion was taken to Woolwich and brought back, about three miles of road each way that had only just been made good from putting in the main sewer, the wheels sinking sometimes to a depth of 12 inches.

I have another engine to describe, and that shall be done in a few words. It is one invented by Mr. Wellington Lee, of the firm of Lee and Larned, of New York, and manufactured in this country by Messrs. Easton, Amos, and Sons, of Southwark. The boiler is of novel construction, and is composed of gun metal, steel and Lowmoor iron, with a view of obtaining the two essentials of lightness and compactness, securing at the same time a large amount of heating surface, of which there are 228·5 square feet, and of fire-bar surface 4·58 square feet. The boiler is composed of a central furnace, surrounded by a shell, or wall, of vertical water-tubes, surmounted by a steam-drum, which, in ordinary work, is filled with water to about one-third of its height; and from this chamber depends a flat water space, or "suspended slab," the connection with the steam drum being made by a series of vertical tubes. Through these proceed internal tubes by which the products of combustion pass in an intensely heated state to the smoke-box, exposing by this means an annular water space to the action of the heat. A number of short tubes pass, independently of these, through the suspended slab, and the steam drum respectively, through which the heated current also passes; and the entire arrangement is so adapted as to present the greatest possible amount of heating surface obtainable to the action of the fire. Tubes pass from the suspended slab to the water-bottom, into which the bottoms of the outer shell of tubes are secured, thus maintaining a complete circulation of the water throughout the boiler. The steam cylinders are two in number, and are placed immediately forward of the boiler; their diameter is 9 inches with a stroke of 9¼ inches, the two piston rods are coupled direct. The slide valve of one cylinder is actuated by means of a reducing lever placed on the piston-rod of the other cylinder, and operates in such a manner, that when one piston is at the end of the stroke, the other is at half stroke, and *vice versa*. This arrangement while ensuring the correct action of the slides for admitting and exhausting the steam, is not of itself sufficient to ensure the proper length of stroke, but avoids the breaking of piston or cylinder cover which might perhaps occur. To guard against this, two additional parts are provided, so arranged, that the exhaust is imprisoned shortly before the termination of the stroke, and the piston starts smoothly and evenly on its return, and however rapid may be the running, the motion is as certain and even as in two engines working with cranks at right angles upon one shaft. The pumps are two in number, each 5⅝ inches diameter; but the plungers and seats may be changed in about twenty minutes for others of larger diameter, in case a greater quantity of water may be required. The length of stroke is 9¼ inches diameter, and being double acting, a steady and continuous stream is obtained from them. Each pump has eight suction and eight delivery valves of india-rubber working upon gun metal guards, offering an effective water way of fifteen square inches (in four valves), or very nearly two-thirds the area of the piston for the contents of one pump. The largeness of the water ways, combined with the peculiar stop at the end of each stroke, which is a main feature of the slide valve motion, causes the almost instantaneous closing of the valves, and the pumps run free from concussion or vibration at any practicable velocity. The net area of the suction opening is 16 square inches, and, having a continuous stream passing through it, the hose remains steady and quiet when the pumps are running at their highest velocity; moreover, advantage is taken of the hollow spaces of the hand railing to connect them with the suction valve chamber, so as to form a suction air vessel. The engine is hung upon a wrought-iron framing, forged entire. Fisher's busk springs, as offering the greatest elasticity and lightness, are employed, with relieving screws for locking them out of gear when working. The nett weight of the engine is 3 tons 2½ cwt. Steam has been raised in five minutes.

Having received Mr. Hodges' directions to design a steam fire-engine, I carefully examined the plans of all the steam fire-engines that have been made. I came to the conclusion that Lee and Co.'s pumps were practically the best, but was not prepared to say their boiler was. I designed the engine as shown in the diagram on the wall. The plan of the boiler I am not at present prepared to make known, and it will be seen that I use a springing fore-carriage, composed entirely of one flat spring, fastened at one end, and allowed to play at the other. I use by preference four 3-inch deliveries, and one 6 inch suction. The steam cylinders are 8¾ inches diameter by 9 inches stroke, and the pump cylinders 5 inches diameter by 9 inches stroke. On the top of the pumps is arranged a box for carrying hose and other implements, serving at the same time as a seat for the driver and two firemen, and behind, a standing

room for three firemen, whilst the stoker and engine driver will ride on the foot plate behind.

I now come to a description of steam fire-engines used for service on the water, and here Mr. Braithwaite was also the first to advocate their use, for he designed a floating engine, and submitted it to the London Fire Engine Establishment in 1836.* Previous to the year 1852, the most powerful fire engines in London were two floating ones on the river, belonging to the London Fire Engine Establishment. The largest of these was worked by 120 men, and, when well manned, was a very effective machine. The great increase, however, in the size of the dock and waterside warehouses, led in that year to an alteration in this engine, whereby the apparatus for manual power was removed, and steam power substituted, doubling the power of the engine. The advantages accruing from this proceeding were so manifest that, in 1855, the directors of the London Fire Engine Establishment caused an entirely new floating steam fire engine to be constructed. This was accordingly designed and constructed by Messrs. Shand and Mason, and has at various large fires performed efficient service. The steam-engines propel the boat by means of two stern jets of water, thrown by a centrifugal pump; they are nominally of 80 horse-power, but are frequently worked up to double that amount. It has two steam cylinders, each 14 inches diameter, and water cylinders of 10 inches, with a stroke of 18 inches. Two donkey engines are erected on the sides, to supply the boilers with water.

At the great fire in Tooley-street, this engine worked 384 consecutive hours. The London Fire Engine Establishment have recently had alterations made in the mode of propelling this boat, which may, I think, be termed most unsatisfactory. The propelling jets are now projected above the water, and against the air only. Action and re-action being in all cases equal, and the resistance of water being greater than that of air, it is manifest that the alteration just made, at a very considerable expense, is an injudicious one. I witnessed a trial of her powers, and the conclusions I formed were, that her speed was diminished, and the supposed improvements made her sluggish at the stern, taking over five minutes to turn round. Messrs. Merryweather and Son constructed two very efficient steam fire-engines, which are fixed in the tug boats on the river Tyne. They were designed by Mr. Edward Field, C.E. They are fixed in the fore part of the tug boats, and connected to the ordinary boiler used for propelling. The steam being always kept up for shipping emergencies, it will be seen that these engines are ready at a moment's notice. Each engine consists of two inclined steam cylinders, each 16 inches diameter and 12 inches stroke, both working direct on to one crank, from which the piston rods of the pump are worked. The pumps are of gun metal, and are 9 inches diameter by 10 inches stroke. The usual working speed is from 60 to 80 revolutions per minute, with a steam pressure of but 17 lbs. per square inch. These engines have been found to deliver continuously a steady stream of 1⅛-inches in diameter to a distance of 163 feet, and a 1¼ inch stream to a distance of 134 feet. For fire duty, two ⅞ inch nozzles are generally used, and are found very effective. They were designed to occupy a very small space, being only 8 feet long by 2 feet 6 inches wide. Working with a higher pressure of steam these engines would, of course, give greater results.

Mr. William Roberts has fixed in the tug boat *Lucy*, belonging to the West India Dock Company, a steam fire-engine, in which he uses his patent pumps.

In bringing my paper to a close, I can only assure you that it was with considerable diffidence I approached a subject of such magnitude; but feeling the great importance of it to a great commercial community, and having had practical opportunities of making myself acquainted with the subject through all its minute details and workings, I was desirous of addressing this Society, and, through it, the public generally. I trust my labour has not been in vain. Should there be in any portion of the paper any errors, either of detail or judgment, I am open to conviction from the gentlemen who will take part in the discussion, if they can adduce sufficiently good proof in support of any disputed point. At this juncture, I wish to convey my thanks to Messrs. Hodges, Baddeley, Braithwaite, and the fire-engine makers for their courteous attention and kindness in supplying me with information. I will now leave the subject in your hands, trusting that it may be discussed in a fair and candid manner.

TABLE OF RESULTS OF ACTUAL PUBLIC TRIALS OF STEAM FIRE ENGINES.

ENGINE MAKERS.	Steam Pressure.	Horizontal Distance.	Vertical Height.	Size of Jet.	NUMBER OF GALLONS DELIVERED.
Messrs. Easton, Amos, and Sons. (Lee and Co.'s Patent.)	120 lbs. 140 „	222 ft. 202 „	175 ft. 160 „	1¼ in. 1½ „	448 gallons in 1 minute 5 seconds, through 1½-inch jet.
Messrs. Merryweather and Son.	120 lbs. 140 „ 145 „	215 ft. 220 „ 190 „	165 ft. 170 „ 150 „	1¼ in. 1¼ „ 1½ „	448 gallons in 1 minute 11 seconds, through 1⅜-inch jet.
Messrs. Shand and Mason.	120 lbs. 150 „	190 ft. 220 „	150 ft. 170 „	1¼ in. 1¼ „	448 gallons in 1 minute 15 seconds, through two 1-inch jets.

DISCUSSION.

Mr. F. HODGES, responding to the call of the chairman, said that Lee's boiler for steam fire-engines, which had lately been brought out in this country, was a very good one. The only question with him was whether it was not a little too complicated as regarded the tubes, which from their arrangement appeared likely to require frequent cleaning out. The working of it, as far as he had seen at present, was very satisfactory. He should be glad to hear what Mr. Lee had to say about it.

Mr. LEE had not intended to have said a word upon this subject, but having been called upon he would say, in reply to what had fallen from Mr. Hodges, that he did not regard the fact of employing a great number of tubes in his boiler as any evidence of complication. The tubes were placed one inside the other, but the junctions of the tubes were made as easily as in any other arrangement.

* See *Mechanic's Magazine*, vol. 26, page 18, where this engine is described and illustrated.

With regard to their requiring to be frequently cleaned out, experience showed that that was not the case, as he had had some of these boilers in use for six years without requiring cleaning. The action through the tubes was so rapid, and the circulation of the water through them so strong, that there was no opportunity for matters to settle in them.

Mr. Hodges said he should be glad to hear from Mr. Roberts a description of Benson's boiler, which he believed that gentleman had used in his own engine.

Mr. Baddeley said Mr. King had given a description of Messrs. Titus Salt and Co.'s fire-proof mill at Saltaire, which appeared to be constructed on a very good principle, but there was a more recent plan of fire proof building, which he thought superior. He alluded to Bunnett's fire-proof floor, which was composed of bricks geometrically formed, so as to interlock with each other, an arrangement which enabled the floor to be made either slightly convex, or completely flat, and the straining of the walls was prevented by tie rods embedded in the bricks. Mr. Bunnett had constructed a floor of that description at Deptford, which had been tested as to its strength, and also as to its fire-proof qualities, and the non-conducting power of the bricks was such that, with the largest fire they could place beneath it, it was impossible to ignite sulphur or gunpowder on the upper side of the floor. It appeared to him to be the most perfect fire-proof floor he had ever met with. The plan described in the paper as that of Mr. Beattie, of carrying pipes round the room and discharging water from various points, was by no means a novel one, having been mentioned in the works of Sir William Congreve, since which time it had been the subject of two or three patents; but in practice it had not been found so valuable as in theory it might appear to be. Since the disastrous fire in Tooley-street the public mind had been very much directed to this subject, and there had been a general leaning towards providing against the recurrence of a similar catastrophe; but he was afraid the more important point of prevention in the early stages of fires had been, to a great extent, overlooked. In its early stage, fire, in most cases, was quite manageable, and that was the time at which it could be dealt with with the greatest chance of success. Of all the modern inventions for fire extinguishing purposes, nothing, in his opinion, was so really useful as the little hand-pump. Many years of controversy ensued before the late Mr. Braidwood could be brought to regard the hand-pump with favour. The first trial that gentleman made with the hand-pump was with an old one, which was constructed previously to the fire of London, and belonged to the parish of St. Dionis, Backchurch. He believed there were five still remaining out of half-a-dozen of those pumps made originally, but the trial of that hand-pump led to the construction of an apparatus of the same description, which kept up a continuous stream of water, and the results of the experiments with those little hand engines were so satisfactory that every fire-engine in London travelled with one, and they had been the means, in the hands both of firemen and civilians, of saving thousands of pounds worth of property. Mr. King had alluded to the question of economy in the arrangements for extinguishing fires, and he (Mr. Baddeley) thought this question had never yet been fairly considered. The work of fire extinction in the metropolis being for the most part in the hands of wealthy bodies, they had not studied the question of economy, but when the matter was to be taken up by the public, this became a question of considerable importance. In Liverpool, Manchester, and other large towns, water, furnished at high pressure from the mains, had been found both efficient and economical. In some parts of London the pressure on the mains was quite sufficient for the extinguishing of fires without the use of engines. In Islington the fire-engine was very seldom employed. The hose was attached to a stand-pipe, from which a jet of water from thirty to forty feet high could be obtained, and this was sufficient. There was, however, great prejudice against this plan on the part of the superintendents of the London Fire Brigade; it was not looked upon as an orthodox mode of proceeding; and some of the district superintendents would sooner pay out of their own pockets the expenses of working an engine, than resort to the stand-pipe and pressure from the mains. He believed that, with regard to the great majority of fires in London, the pressure of water from the mains would be sufficient for their extinction if applied at once. He had seen four brigade engines set to work to extinguish a penny bundle of wood which had become ignited under the cellar stairs of a public-house, whilst at the same spot the pressure in the mains was sufficient to throw a stream of water forty feet high. It became an important public question, how far greater economy might be introduced into the fire-extinguishing establishments of London. The other portions of Mr. King's paper appeared so satisfactory as to call for no remark.

Mr. Wm. Roberts said there were but few statements in the paper with which he did not entirely agree, but upon one or two points he did not concur with Mr. King. He did not agree with him that it was generally understood that large fires were inextinguishable. He had had some experience, during twenty-four years, as a volunteer fireman, and had had a brigade of his own during the last four or five years. There were few people who had not heard of that unfortunate locality with regard to fires, Millwall. A few years ago it was notorious for the number of fires that occurred there, but now a fire there was a rarity. Previously to the establishment of his own brigade, the nearest fire-engine station was about 3½ miles distant; the consequence was, a fire had time to get a-head before any water could be put upon it. He had been present with his brigade at fires which at first threatened to be serious. He might especially mention a fire which broke out at a rope factory, in which there were stored about thirty tons of tarred hemp, ready for spinning, and, although it was well alight, the fire was stopped before the arrival of any of the London Brigade engines. He agreed with Mr. King that there was a mistake in the mode of attacking fires. Many persons attacked them from the top, his own plan was always to set to work at the bottom. He never threw water upon the top unless it was to prevent the fire spreading to the next house. He had succeeded in extinguishing a fire at a paraffin oil factory, where 1,000 gallons of oil escaped from a still, and this fire was subdued in twenty minutes, and they were coiling up their hose when the first London Brigade engine arrived at the spot. For the last 18 months only one serious fire had occurred in the Isle of Dogs. He recommended all persons who carried on dangerous trades to have the water laid on to their premises from the mains with stand pipes. There were very few chemical works in his own neighbourhood which were not so provided, and the workmen were periodically drilled in the running out of the hose from the stand pipe, and in all the operations necessary for subduing a fire. His own experience had been, that in the majority of instances all fires were extinguishable if properly attacked. With regard to the steam fire-engine, it was a subject to which he had devoted considerable attention for many years. Seven or eight years ago he offered to make a steam fire-engine at his own cost, and permit the London Fire Brigade the free use of it for a certain period; but the late Mr. Braidwood was then opposed to the use of steam, as he considered the water supply of London was insufficient for it, but it was found that the supply was quite sufficient for a moderate sized steam fire-engine. With regard to Benson's boiler, to which Mr. Hodges had alluded, it was properly speaking a Latta boiler. Benson's boiler was a water-shell with a quantity of tubes inside it, and a pump was employed to circulate the water through the tubes which were always supposed to be filled. He was sorry to say he had a great deal of trouble with his engine in the first instance, but by the introduction of some modifications in

the boiler, the steam was raised as well as he could desire. It was stated that in America the steam was got up in these boilers in from four to five minutes. If that could be done in America he saw no reason why it should not be done in England; but he had never seen a boiler yet that would do it. A reckless American suggested that the fire should be lighted first, and the water introduced when the boiler was hot, and that so the steam could then be got up very quickly, but he had too much regard for his personal safety to follow that advice. With cold water in the tubes he could not get the steam up to working pressure in less than twenty minutes, but by banking up the fire with small coal he could keep the water warm for a great many hours, and could then raise the steam in four minutes, and in five minutes he had 100 lbs. of steam and was running along the road. He had only seen experiments with Lee's boiler upon one occasion, and then it took twenty minutes to get up the steam. Mr. King considered he had designed a better boiler, and he heartily wished him success. It was stated in Mr. King's paper that he (Mr. Roberts) fitted the tug *Lucy* with a steam fire-engine. That was not quite correct. Three or four years ago, he was called upon to put a pair of his pumps into the *Lucy*, to be worked by the ordinary engines of the boat; this he did, and they proved to be some of the most powerful pumps ever constructed, and were capable of delivering 30 gallons of water per stroke, through a 2½-inch hose, to a distance of 210 feet, and he believed the West India Dock Company at the present moment possessed the most powerful floating fire-engine in London.

Mr. GLASS was inclined to think this was more a chemical question than a mechanical one. They had spoken entirely of the application of water by mechanical means, in a fluid state, to the extinction of fires. The great object, in a chemical point of view, was to deprive the materials in combustion of the elements which most contributed to combustion. If the oxygen of the atmosphere were withdrawn, they had then carbonic acid, nitrogen, and watery vapour, all of which tended to extinguish fire. Mr. Phillips, in his fire annihilator, had employed carbonic acid with a certain amount of success; but perhaps the quantity employed was not sufficient. If, however, this could be supplied in sufficient quantity, no doubt any fire could be extinguished by it. His own impression was that the better way of applying water would be in the state of high pressure steam. If steam were allowed to rush into the lower part of a burning building, he thought that would be the most effectual way of extinguishing the fire. The object was to substitute another atmosphere for that of oxygen, and that could be done by high pressure steam, which would reduce the temperature of the burning materials below that which was necessary for combustion; or the oxygen of the atmosphere might be absorbed by the combustion of a carbonaceous material. The object for which he principally rose was to suggest the application of high pressure steam to the extinction of fires.

Mr. ROBERTS said he had applied steam in the way suggested in several cases during the last twelvemonths; there was, however, some difficulty in getting an apparatus that was easily manageable. He had partly designed an engine in which either steam or water might be used. The suggestion was made to him some eighteen months ago by the Chairman of the West India Docks.

Mr. GLASS added that he thought the addition of a salt of ammonia to the water employed for extinguishing fires would tend to increase its efficacy.

The CHAIRMAN said he saw present Mr. Porter, a gentleman from New York, and after having heard of the excellent organization which existed in that city for the extinction of fires, he was sure any particulars that could be given on that subject would be highly interesting to the meeting.

Mr. PORTER said his attention had never been very closely drawn to the steam fire engines in New York, so as to enable him to speak of them in any detail, and he had only that general knowledge of them which any tolerably well-informed citizen might be supposed to possess. His friend Mr. Lee, as the manufacturer of between 60 and 70 steam fire engines, which were used in all the principal cities of the United States, was especially qualified to give them the particulars of their construction. He wished to remark, with respect to the trial of Mr. Lee's steam fire-engine on the premises of Mr. Hodges, that using water in the boiler at a temperature of 44 degrees, the steam began to rise in 6 minutes and a quarter. At that time an inconsiderate fireman put a quantity of coke on, which nearly extinguished the fire, and under those circumstances it was 20 minutes before a pressure of 40 or 50 lbs. was obtained. He regarded that as an exceptional case. He had seen a working pressure obtained in that boiler in about ten minutes with all the tubes filled with water.

Mr. PHILIP PALMER said there was one important question to be solved, that was—the best mode in which all these valuable appliances could be brought into practical operation, or into one common centre. He had been connected with one of the oldest fire offices in London, as a director, for nearly twenty years, and was gratified to hear the testimony that had been borne by Mr. King to the services rendered by the London Fire Brigade. The great question to be solved was whether that brigade was sufficient for the public service, and whether it was in a position to command those valuable inventions and appliances which had been brought under their notice this evening. They had the eminent services of such men as Mr. Hodges and Mr. Roberts in connection with the brigades which those gentlemen had organised; but notwithstanding all the individual energy that was displayed, they sometimes read accounts in the newspapers which showed that some more perfect and combined organisation was required. Now was the time for discussing what was the best system that could be introduced for protecting London from the ravages of fire. He was sorry that the discussion had been almost entirely on the construction of engines and similar matters of detail, because it appeared to him that the most important part of the question was in what way these valuable appliances could best be brought to bear. He could not agree with the remark of Mr. Baddeley, that in the operations of the London brigade the question of economy was not regarded by the fire offices by which it was supported. He had always considered that economy was a great point with them, and this was a question which had in some degree led to the introduction of a bill in parliament on the subject. He should be glad to hear the opinion of Mr. King, if he had formed one, as to the best way in which these various appliances could be practically brought to bear upon the public service. Speaking individually, he preferred that the government should have nothing to do with the matter, because, if they had, he thought it might not to be so well managed as it was now. He should like to see some popular system established, still under the management of the fire offices, or at any rate that they should have a share in its direction.

Mr. WENTWORTH SCOTT said, reverting to the chemical portion of the subject, he would warn them against the use of carbonate of ammonia in the water used for the extinction of fires, as, so far from becoming decomposed by coming in contact with incandescent surfaces, it would produce a vapour very offensive to the eyes and noses of all persons near it. Some years ago, during the Russian war, he made experiments upon various highly inflammable substances, including phosphorus, and was therefore solicitous to provide himself with the means of extinguishing a fire, in case it should arise from such very combustible materials. A very few experiments sufficed to convince him that, whilst water did very well for extinguishing fire upon a solid incandescent substance, it had no effect whatever upon flame such as that of burning turpentine or tallow. This could only be extinguished by bringing an antagonistic vapour to bear upon it. The idea of changing the atmosphere within an ignited building might look well on paper, but was very difficult of accomplish-

ment. The action of the flames caused such an intense draught through the building, and the consumption of atmospheric air was so enormous that the entire atmosphere would be changed several times in the space of a minute. Let them judge then of the difficulty—not to say the impossibility—of changing the atmosphere of a burning house in the way that had been suggested. There were some substances known to chemists which would produce the effect described upon the oxygen of the atmosphere. Prussic acid was one; but he should not be inclined to recommend the vapour of that acid for extinguishing fires. But chloroform might be used with great effect, and without the like injurious results. When mixed in small quantities with water—from two to three per cent. —and injected upon any kind of burning material, it acted very efficiently by cooling the hot solid particles, and rendered the air incapable of supporting combustion. It would extinguish flames which water, as water, could never do.

Mr. H. W. Reveley, seeing so many persons present who were acquainted with the management of fires, begged to inquire whether the firemen were drilled to attack the fire "between wind and water" as it was termed, because that would put a fire out more rapidly. The fire must be attacked at the root of the flame, and the jet should be moved along as the flame became gradually extinguished, driving, as it were, the flame before it.

Mr. Olrick gave some explanations of the boiler invented by Mr. Field, and used in Merryweather's steam fire-engine, and mentioned some points of excellence which he considered it possessed over some other descriptions of boilers.

After a few remarks from Mr. Inglis and Mr. Stabler,

Mr. King, in reply upon the discussion, said there were but few remarks which called for any observation from him. In his description of Mr. Lee's boiler, he intended no disparagement to it as a boi'er, but he thought it was too complicated in its parts, and too expensive in its manufacture, to be practically of service in steam fire-engines. With regard to the remark of Mr. Roberts, that he considered large fires extinguishable, that gentleman had not given them any instances of large fires which he had extinguished, and he apprehended his successful encounters with fires had been when an early attack was made upon them. With reference to the suggestion of Mr. Glass, as to the use of high pressure steam, he thought there was a great deal in it, but it was difficult to design an apparatus suitable for applying the steam. He had only now to thank the meeting for the kind manner in which his paper had been received.

The Chairman said, before he asked the meeting to agree to a vote of thanks, which he was sure would be heartily accorded to Mr. King for the able paper he had read, he would make one or two very brief remarks. He would reply to the observations of Mr. Palmer by saying, it appeared to him that the subject that gentleman alluded to had been scarcely touched upon this evening. They had been considering the various practical means by which fires might be put out, but they had scarcely touched upon the question of how these various means could be best applied. He thought that was a subject of great importance in the metropolis; but it was a large question, and would require a great deal more discussion than they were able to give it this evening. He begged Mr. Palmer to understand that he did not undervalue the importance of that subject, although the present discussion had hardly touched upon it. This question would be well worthy of consideration on a future occasion, and he should be glad to take part in any discussion that might arise upon it. It must always be remembered, that however valuable the services of private individuals might be, they could not always depend upon having such men as Mr. Hodges and Mr. Roberts at their command. London had derived the greatest benefit from the services of those and other gentlemen, but from nobody more than from Mr. Hodges. The public spirit he had shown—the way in which he had administered his really large establishment of fire-engines, entirely under his own direction, was not only highly creditable to himself, but eminently useful to this city; but such men were not always to be found, and therefore the subject of making provision for the greater security of life and property in London was one which should not be lost sight of. It was high time that the public roused themselves, in order to put the establishment of the fire brigade of the metropolis on a more permanent, more secure, and more efficient footing; and he begged to add, in using the term "efficient," he did not, for a moment, disparage the services of the late Mr. Braidwood, or those of Capt. Shaw, the present chief of the London Fire Brigade. Both were as good men as could be found, and he believed the London Fire Brigade was at the present moment in as efficient a state as was possible under the circumstances, but still it had not that perfect organisation which he thought was necessary in a metropolis like this. That was a subject, however, on which he would not now make more than a passing remark. The gentleman who had spoken with regard to the modes of using chemical substances for the extinction of fires, he thought ought always to recollect how difficult it was in small country towns and villages to have anything but the simplest contrivances; and therefore, however valuable many of these schemes might be theoretically, and however clearly they might be proved to be efficient, if directed by an able chemist, still in the hands of inexperienced persons in the country, those appliances might prove to be total failures. What they should consider in London was, in what way these appliances so ably introduced to their notice could be best brought into use for the benefit and security of life and property. With regard to the construction of engines, the name of Mr. Lee was worthy of the highest mention as having been the manufacturer of those efficient engines which were brought under public notice in the inquiry made last year before a Parliamentary Committee. They had this evening heard some remarks from Mr. Baddeley, who, he believed was connected with, and had rendered most efficient service to the public through that valuable institution known as the Fire Escape Association. That was an institution which, by the most simple means, had rendered, and was still likely to render, great public services; for the first duty was—as he was sure it always would be—in the case of fire, to protect human life. He could not forbear to call attention to that institution, knowing, as he did, its great value. He would conclude by asking the meeting to agree with him in expressing their warmest thanks to Mr. King for the valuable paper he had read to them.

The vote of thanks having been passed,

The Secretary announced that on Wednesday evening next, the 25th March, a paper by Mr. Clements R. Markham, F.S.A., "On the Supply of Quinine, and the Cultivation of the Chinchona Plants in India," would be read. On this evening Thos. King Chambers, Esq., M.D., will preside.

THE TURKISH INDUSTRIAL EXHIBITION.

The *Times* correspondent gives the following account:—

Those of your readers who have visited Constantinople will remember to have seen—and others who have not had such an opportunity will have read or heard of—the famous Hippodrome or Atmeidan. This place, connected with so many historical associations, both ancient and of our own time, although divested of its primeval splendour, is still one of the most interesting sights of Stamboul. In

addition to the monuments of antiquity with which it abounds—such as the Obelisk of Theodosius, the Serpentine Column, and the remains of the walled Pyramid, which all stand in a line, describing the axis of the ancient circus—it has other advantages which peculiarly fit it for the purpose for which it has now been selected. In its immediate vicinity, and within full view, St. Sophia and the magnificent mosque of Sultan Achmet, which now occupies a portion of the original circus, stand out in bold and majestic relief. A number of hovels and dilapidated buildings, it is true, rather mar the general effect, but not to the extent of diminishing or effacing its beauty. This square, which so often witnessed revolts among the Janissaries and also the commencement of their extermination, has now been appropriated as the arena for the more peaceful purposes of an industrial and commercial competition. The unpretentious but not ungraceful structures which have been erected in the centre of the square consist of a principal building and an annexe, the two being intersected by the granite obelisk. As it was impossible to provide the necessary amount of space without encroaching on some of the monuments, the Serpentine Column was included bodily in the annexe, in the centre of which it stands, enclosed by an iron railing, a grim reminiscence of antiquity frowning on steam monsters in the form of locomotives, steam-engines, and other such practical encroachments of the present times over the past. The whole building comprising the annexe covers an area of 12,000 Turkish *pics*—something over two acres. It is a mixture of Turkish and Moorish architecture, with an Alhambric porch, and forms altogether a very pleasing and light structure. The main building consists of four aisles, in the centre of which there is an Oriental Court, with marble fountain, and a profusion of plants and exotics. The whole is glazed on the top, to admit sufficient light.

Before proceeding, however, with any description of the interior of the building and its contents, it is well to state briefly the origin of the undertaking itself. By many people the first idea is attributed to the Sultan. Others affirm that it originated with Nazim Bey, a son of Fuad Pasha and chief Ottoman Commissioner to the London Exhibition of 1862. Be that as it may, the Sultan has given the greatest encouragement to the scheme from the first, and has, even in his over-eagerness to see it in operation, exercised such pressure on those connected with its details that, although the building has been opened to the public for a week, the arrangements are still involved in the greatest confusion, and it will be a long time before it assumes anything like completeness.

Although receiving every assistance from the Government, including, it is said, a pecuniary subvention, the undertaking is the result of private speculation; and I fear that the Commission, in its eagerness to secure a commercial success, will lose sight of the other and more important interests which such an enterprise should have in view. A certain sum of money was subscribed by the different members of the Commission, which is to cover the expense of the building and the purchase of most of the objects to be exhibited. It must not be imagined, nor would it be reasonable to expect, that in such a vast empire, a great proportion of which is in a state of barbarism, the same appreciation of the benefits and advantages resulting from an Industrial Exhibition is felt by the people of this country, as that which animates the trading and industrial classes in Europe. If reliance had been placed upon any such spontaneous contribution, the chances are that the walls of the Exhibition would have remained bare. It was necessary, therefore, for the most part, to purchase the articles worthy of show; and it is to be feared that, in the interest of economy and of their pockets, the Commissioners have not made such a selection, in all cases, as would properly represent the capabilities of the country. The power with which the Commissioners were invested by the Government, in the furtherance of the scheme, has, moreover, it would seem, been used by them, or more probably by their agents in the provinces, in an arbitrary and unwarrantable manner, in extorting from the tradespeople their productions at prices below their real value. The natural consequence is, that it created a disinclination on their part to dispose of their best articles, and the show from the provinces, which might have been so beautiful and interesting, has fallen far below the general expectation. To purchase cheap and sell dear in such an instance is not the best means to encourage the trading classes, or to demonstrate to them the advantages of a public Exhibition.

In their natural ignorance and inexperience of such a matter, it would have been the duty of the Commissioners to call in the assistance of a certain number of practical and intelligent Europeans to lay down the general principles and assist in carrying out the difficult details of such an enterprise, the complicated nature of which requires the most perfect organisation. It should also have been the duty of the Government to insist upon the adoption of a system which, without interfering with the legitimate interests of private speculation, should have secured a public value and a statistical result. I fear that these important considerations have been, in a great measure, neglected and overlooked. In their self-sufficiency and impatience of European control, the Turks determined to carry out the work unassisted. At the outset, and at the suggestion of a French scientific gentleman, it was determined that a similar system to that pursued in England and France should be adopted, separating the contributions of the different provinces, so as to show the comparative capabilities of each, and then into classes and sections. The Exhibition was to have been divided into 14 different classes. Under his guidance and supervision the classification was proceeding satisfactorily, when suddenly the system was abandoned as too cumbrous, and the consequent disorder and confusion set in which I apprehend it is now too late to remedy. The catalogue, which should contain upwards of 15,000 different numbers, is proceeding at the rate of from 50 to 100 a day; so that there is a probability that it will not be completed by the time the Exhibition closes. It seems, moreover, that the Sultan issued orders for the opening of the Exhibition on a certain day, giving three days' time to complete all the arrangements. As it is difficult to reason with Sultans and dangerous to trifle with their commands, however unreasonable and arbitrary they may be, no representation was made to him as to the incompleteness of the work; and on Friday last, the day fixed by him, the Turkish Industrial Exhibition was opened by the Sultan in person. A week before the public, and even the Commissioners themselves, did not believe it possible that it could be opened before one month. Contrary to general expectation, no great solemnity was observed on Friday last. The Diplomatic Corps even were not invited to be present. It seems that the great ceremony is deferred to the time of the distribution of awards and prizes. There was no one present but the Commissioners and the Turkish Ministers. The Sultan walked round the building and expressed his approval of the arrangements. He bestowed a valuable jewelled watch on Fuad Pasha, as a *souvenir* of the occasion. He does not seem to have paid much attention to anything in particular, with the exception of a crayon copy of a drawing representing a mounted Mameluke in all the excitement of battle. The original, by Horace Vernet, is well known, and lithographic copies of it abound on the Boulevards in Paris. This sketch seems very much to have struck his fancy, for on retiring to the elegant kiosk which is set apart for him in the building, and from a latticed balcony of which he can command the whole Exhibition, he asked that it should be brought to him. He left the building after some time, and has since repeated his visit on two occasions.

It is now time to look into the interior of the building, and give a general idea of its contents and appearance. After all the defects in management

which I have pointed out, one is agreeably surprised by the *coup d'œil* obtained inside. The general arrangements and disposition of the various articles have been carried out with a degree of taste and judgment which I have much pleasure in recording. It is true that the very first impression produced is that a great deal in the way of utility has been sacrificed to show. Nor must one be too hard upon the Commissioners for this. It is so much in the character of Orientals that it could hardly be expected that they would have departed from the rule on an occasion like the present. All their gorgeous and glittering productions—the magnificent carpets and rugs of Anatolia and Smyrna; the silver and gold brocades of Aleppo, Damascus, and Bagdad; the richly embroidered prayer carpets and tapestries of Brussa; the smart costumes of Janina and Albania; the gaudy-coloured tissues of the Imperial factory; a costly collection of pipes, tastefully arranged in a trophy; the beautiful silver filagree ornaments of Tunis and Tripoli; last, but not least, a selection of Palace and Crown jewels, valued, I am informed, at upwards of two millions sterling—these are the things which first meet and enchant the eye; while the more profitable and more important productions of the country are huddled together out of sight, so as not to disturb the harmony and magnificence of the general effect. The inexhaustible fertility of the soil is represented by the cereal productions of the country, a great portion of which, alas! for want of roads, rot on the place of their growth. The silk cocoon, so important a source of revenue to the government, the wool, the cotton, the productions of their olive woods, the incalculable riches of their virgin forests, and a thousand other valuable productions too numerous to be recorded here—all these are but poorly represented, and difficult to be found. Enough is seen of them, however, by those who look with a critical and observing eye, to show the great wealth of the country, and the enormous productive and commercial importance with which a proper administration might so easily endow it.

Considering the apathy of Orientals in such things, a very good attendance has been secured since the opening, which goes on increasing. On the first two or three days the people admitted averaged 3,000. Yesterday 5,000 visited the building, which was not very crowded. Wednesdays and Saturdays are reserved for ladies only. The price of admission is 6d., excepting on Wednesdays and Fridays, when it is 1s.

It is curious to see the variety of Oriental costume among the visitors. Turks of the old school in their sober pelisses and white or green turbans, swarthy Arabs in gaudy-coloured robes, Persians in their high conical caps, Circassians in their beautiful costume—all these, contrasting so greatly with the uniform and uninteresting garb of a European crowd, tend, together with the peculiar decorations of the building, to invest this exhibition with a picturesque effect, quite refreshing to Europeans.

In a future letter, I will describe such of the contents as are worthy of notice.

INSTITUTION OF NAVAL ARCHITECTS.

The Ordinary Meetings for 1863 will be held in the great room of the Society of Arts, on Thursday, 26th March, morning at 12, and evening at 7 o'clock; Friday, 27th March, morning at 12, and evening at 7 o'clock; and Saturday, 28th March, morning at 12 only. The Right Hon. Sir J. S. Pakington, Bart., M.P., G.C.B., D.C.L., President, in the chair.

The following is the programme of proceedings:—

Thursday, March 26.

The following Papers will be read and discussed:—

Morning Meeting, at 12 o'clock.

"On the Naval Architecture of the Exhibition of 1862." By Vice-Admiral Paris, C.B., of the French Imperial Navy; Assoc. I.N.A.

"On the Construction of Iron-plated Ships." By W. Fairbairn, Esq., LL.D., F.R.S., Hon. Assoc. I.N.A.

"On Iron-plated Ships." By. J. D'A. Samuda, Esq., Mem. Council I.N.A.

"On the Present State of the Question at issue between Modern Guns and Iron-coated Ships." By J. Scott Russell, Esq., F.R.S., Vice-President I.N.A.

Evening Meeting, at 7 o'clock.

"On the Steering of Ships." By N. Barnaby, Esq. M.I.N.A.

"On Copper and other Sheathing for the Navy." By W. J. Hay, Esq., F.C.S., Assoc. I.N.A., Chemical Lecturer, Royal Naval College, Portsmouth.

Friday, March 27.

Morning Meeting, at 12 o'clock.

"Experiments at Sea with a Rotating Ship Clinometer." By Professor C. Piazzi Smyth, F.R.S., &c., Astronomer-Royal of Scotland.

"On the Rolling of Ships as influenced by the Disposition of their Weights." By J. Scott Russell, Esq., F.R.S., Vice-President I.N.A.

"On the Resistance of the Medium as Limiting the Angles of Rolling." By W. Froude, Esq., Assoc. I.N.A.

"On Isochronism of Oscillation in Floating Bodies." By W. Froude, Esq., Assoc. I.N.A.

"On Iron-clad Sea-going Shield Ships." By Capt. Cowper P. Coles, R.N., Assoc. I.N.A.

Evening Meeting, at 7 o'clock.

"On the Construction and Support of Iron and other Masts and Spars." By Charles Lamport, Esq., Assoc. I.N.A.

"On an Improved Method of Framing Iron Bulkheads." By G. C. Mackrow, Esq., Assoc. I.N.A.

"On the Protection of Iron from Oxidation and Fouling." By W. J. Hay, Esq., F.C.S., Assoc. I.N.A., &c.

Saturday, March 28.

Concluding Meeting, at 12 o'clock.

"On the Education of Naval Architects in England and France." By J. Scott Russell, Esq., Vice-President, I.N.A.

"On the Origin and Construction of Her Majesty's Yacht *Fairy*." By T. J. Ditchburn, Esq., M.I.N.A.

"On an Instrument for Measuring the Strain on Ships' Cables." By T. M. Gladstone, Esq., C.E.

"On a Curious Form of Differential Wave in a Stratified Fluid, with an Experimental Illustration." By W. Froude, Esq., Assoc. I.N.A.

The offices of the Institution are at 7, Adelphi-terrace, Strand, W.C.

INSTRUMENT FOR SOUNDING ALARUMS AND ACTUATING VENTILATORS.

The object of the apparatus, the invention of Mr. George Hawkesley, is to sound an alarum, or open a ventilator, when the temperature of a room is increased beyond that at which the apparatus is set to go off. A strip of metal, which expands freely with heat, by preference of zinc, is attached at one end to a screw or other instrument, capable of being moved or adjusted; the other end is attached to the shorter end of a lever mounted to a fixed centre, and to the longer end of it is attached one end of another expansion strip, and the other end of this second strip is attached to the shorter end of a second lever, which in turn has a third expansion strip attached to it, and so on, the number of the strips employed depending on the degree of delicacy required in the instrument. The last of the series of levers is connected with a spring or other

suitable instrument, which keeps the expansion strip at all times in a state of tension. The last of the series of levers carries the instrument which acts on the detent or stop of the sounding apparatus, or of the power apparatus for working the ventilator, and such last lever is made with a point, which moves over or opposite a graduated scale commencing at zero, and so divided that if the lever by the screw or adjusting apparatus is moved to a particular degree or division on the index the apparatus will go off when the heat rises to that extent above the temperature at which the thermometer stood at the time of setting the apparatus.

Home Correspondence.

INTERNATIONAL TRANSIT THROUGH CENTRAL AMERICA.

SIR,—After the very able paper read by Captain Pim, on the 11th inst., and the discussion upon this subject by many eminent men, it would seem almost superfluous to offer any further opinion, but some very strong points appear to have been entirely lost sight of on that occasion.

Presuming, of course, that the undertaking is to be international, the amount of capital required is not an object of so much importance as that it shall be economically expended, having due regard to the permanent benefit of the world at large.

Now there is no doubt whatever, that a clear ship passage would be infinitely superior to a railway, a mere apology for a truly paying commercial transit, especially with a line of 225 miles, when the shortest distance across the isthmus is only 27½ miles, and in that respect I entirely agree with what fell from Mr. Parke Pittar on that evening.

The objections to a ship canal are:—The supposed difference of level of the two seas, material time required for execution, the great expense, and bad harbours at each end.

The first difficulty, namely, difference of level, is a bugbear already discarded by all scientific men, or is reduced to that caused by winds and tides—we hear nothing now of such an obstacle in the works of the Suez Canal. When opened, the tide will either flow alternately in both directions, when ships may choose their time of passing, or it may flow constantly in one direction, and powerful steam-tugs, as in all cases, will readily accomplish the passage.

The estimate for the time and expense required will be much reduced by an accurate survey of the various possible shortest lines, which, in all probability, will not exceed double the shortest known distance across, or from forty to fifty miles; and the expense will only be that of forming an open tidal communication between the two seas of the smallest dimensions, when the tidal flow, either or both ways, will soon form a ship canal, or, rather, strait, amply sufficient for ships of the largest class. The expense, however, will necessarily be increased if it be found impracticable to avoid rocky ground, as the force of gunpowder must then be largely employed.

The last objection, namely, bad harbours or shoal water, at either or both entrances, has no foundation in fact, for, of course, a rocky coast will be avoided, while the rush of the tide—especially if assisted by rough stone jetties thrown down at random, in a proper line, on one or both sides of each entrance if required, will soon clear out the straits, and cut a deep channel at each end. No such difficulty will be found when the Suez Canal shall be completely opened to the tidal flow, notwithstanding the miles of shoal water now existing at both ends.

The examples of the Isthmus of Corinth, and the former attempts at Suez, are nothing to the point. There is a mountainous district at Corinth, which the feeble efforts of the Greeks were unable to contend with, and the old Suez Canal was merely an artificial communication with the Nile, when of course no tidal current could be established to clear out and widen the passage.

I am, &c.,
HENRY W. REVELEY.

Reading.

MEETINGS FOR THE ENSUING WEEK.

MON. ...R. Geographical, 8½. 1. Major F. J. Goldsmid, "Memoranda on a March from Kurrachee to Gwadur, on the Mekram Coast, in the cold season of 1861-62." 2. Dr. Duncan Macpherson, "On the Harbour of Sedashagur."
British Architects, 8.
Medical, 8½. Mr. W. J. Coulson, "A Case of Obturator Hernia—Operation."

TUES. ...Medical and Chirurgical, 8½.
Civil Engineers, 8. 1. Mr. J. G. Fraser, "Description of the Lydgate and of the Buckhorn-Weston Railway Tunnels." 2. Mr. W. M. Peniston, "The Public Works in the Province of Pernambuco, Brazil."
Zoological, 9.
Royal Inst., 3. Prof. Marshall, "On Animal Mechanics."
Anthropological, 7½. 1. Captain R. F. Burton, "A Day amongst the Fans." 2. Prof. Raimondi, "Indian Tribes of Loreto, North Peru."
Architectural Museum, South Kensington, 7½. Mr. A. J. Beresford Hope, "On the Condition and Prospects of Architectural Art."

WED. ...Society of Arts, 8. Mr. Clements R. Markham, F.S.A., "On the Supply of Quinine, and the Cultivation of the Chinchona Plants in India."
R. Soc. Literature, 4½.
Archæological Association, 8½. 1. Mr. Pettigrew, "On Thuribles." 2. Mr. Cuming, "On Ancient Snuffers."

THURS...Royal, 8½.
Antiquaries, 8½.
Philosophical Club, 6.
Artists and Amateurs, 8.
Royal Inst., 3. Dr. E. Frankland, "On Chemical Affinity."

FRI.......Royal Inst., 8. Mr. W. Crookes, "On Thallium."
R. United Service Inst., 3.

SAT.......Royal Inst., 3. Professor Max Muller, "On the Science of Language."
Royal Botanic, 3¾.

PARLIAMENTARY REPORTS.

SESSIONAL PRINTED PAPERS.

Par. Numb.

Delivered on 20th February, 1863.

22. Bill—Post-office Savings Banks.
Brazil (British Barque *Prince of Wales*, and her Majesty's Ship *Forte*—Correspondence.
Census of England and Wales, 1861 (Population Tables)—General Index.
Commerce of Naples—Despatch.

Copies of the undermentioned Papers, presented by Command, will be delivered to Members of Parliament applying for the same at the Office for the Sale of Parliamentary Papers, House of Commons:—
1. Agricultural Statistics (Ireland)—Abstracts 1862.
2. Factories—Reports of Inspectors to 31st October, 1862.

Delivered on 21st and 23rd February, 1863.

33. Ticket-of-Leave Prisoners—Return.
45. Trade and Navigation Accounts (31st December, 1862).
49. Dulwich College—Return.
50. Railway and Canal Bills—First Report from the General Committee.
51. Navy (Promotion and Retirement)—Return.
52. Appropriation Act—Copy of Treasury Minute.
25. Bills—Register of Voters.
26. ,, Partnership Law Amendment.
30. ,, Prince and Princess of Wales' Annuities.
Duchy of Cornwall—Report from the Council of H.R.H. the Prince of Wales.

Delivered on 25th and 26th February, 1863.

10. Greenwich Hospital—Return.
53. National Debt (Savings Banks, &c.)—Return.
60. Atlantic Royal Mail Steam Navigation Company—Return.
63. Malt—Return.
64. Malt Bonded—Return.
33. Bill—Bills of Exchange and Notes (Metropolis).

Delivered on 27th February, 1863.

59. Poor Law (Ellen Kane)—Correspondence.
61. Queen Anne's Bounty—Account.
66. Ashton-under-Lyne Union—Return.
35. Bills—Security from Violence.

37. Bills—Malt Duty (amended).
Brazil—Further Correspondence.
29. Railway and Canal, &c., Bills (1. Alyth Railway; 2. Andover and Redbridge Railway; Anglesea Central Railway; 3. Bala and Dolgelley Railway; 4. Barnsley Coal Railway; 5. Belfast, Holywood, and Bangor Railway; Berks and Hants Extension Railway; 6. Bishops Waltham Railway; Blackburn Chorley, and Wigan Railway; 7. Bristol and Exeter Railway; 8. Caledonian Railway (Bredisholm Deviation), (Carstairs and Dolphinton Branch), (Granton Branches), (Improvements, &c.); 9. Carmarthen and Cardigan Railway (No. 1 and No. 2); 10. Central Wales Extension Railway; 11. Charing-cross Railway; 12. Cleveland Railway; 13. Cockermouth and Workington Railway; Cockermouth, Keswick, and Penrith Railway; 14. Cowes and Newport Railway; 15. Dublin, Wicklow, and Wexford Railway; 16. Dulas Valley Mineral Railway; 17. Dundee and Perth and Aberdeen Railway; 18. Ely Valley Extension Railway; 19. Esk Valley Railway; Evesham and Redditch Railway; 20. Farnborough and Aldershott Railway; 21. Fochabers and Garmouth Railway; 22. Glasgow and South Western Railway (Additional Powers), (Capital); 23. Great Eastern Railway (Chatteris and Ramsey Branch); 24. Hadlow Railway; 25. Hammersmith and City Railway; 26. Hereford, Hay, and Brecon Railway; Herne Bay and Canterbury Junction Railway; 27. Kettering and Thrapstone Railway; 28. Kington and Eardisley Railway; 29. London and North Western Railway (New Branch Lines); 30. London and South Western and Andover and Redbridge Railway);—Board of Trade Reports.

Delivered on 28th February and 2nd March, 1863.

41. Revenue Departments—Accounts.
50 (1). Railway and Canal Bills—Second Report from Committee.
67. Sugar and Molasses—Return.
68. Galway Subsidy—Copy of a Letter.
2. Schools (Scotland)—Returns.
21. East India (Army)—Return.
47 (1). Committee of Selection—Second Report.
70. Fisheries (Ireland) Bill (1842)—Minutes of the Proceedings of the Select Committee.
40. Bills—Marriages, &c. (Ireland).
42. „ Salmon Exportation.
34. „ Writs Prohibition.
Russia (Regulations in regard to Trade with the Eastern Coast of the Black Sea)—Correspondence.
29. Railway and Canal, &c., Bills (31. London and South Western Railway; 32. Manchester, Buxton, Matlock, and Midlands Junction Railway; 33. Merthyr, Tredegar, and Abergavenny Railway; 34. Mid Wales Railway (Branch, &c.), (Capital); 35. Mistley, Thorpe, and Walton Railway: 36. Newport Pagnell Railway; 37. Newtown and Machynlleth Railw y (Capital, &c.); 31. Northampton and Banbury Junction Railway; 39. North British Railway (Wansbeck, &c.); 40. North Eastern Railway; Newcastle and Starbeck Branches); 41. Okehampton and Lidford Junction Railway; 42. Ramsey and St. Ives Railway; Rickmansworth, Amersham, and Chesham Railway; 43. Saffron Walden Railway; 44. Scottish Central Railway and Dundee and Perth and Aberdeen Junction; 45. Scottish North Eastern and Dundee and Arbroath Railway; 46. Shrewsbury and Welchpool Railway; 47. South Staffordshire Railway; 48. Stonehouse and Nailsworth Railway; Stourbridge Railway; 49. Vale of Llangollen Railway; 50. Ware, Hadham, and Buntingford Railway; 51. West Hartlepool Harbour and Railway; 52. West London Extension Railway)—Board of Trade Reports.

Delivered on 3rd March, 1863.

56. Revenue Departments—Estimates.
69. West India Islands, &c., Relief—Account.
38. Bills—Telegraphs (amended).
43. „ Innkeepers' Liability (No. 2)
44. „ Union Relief Aid Act (1862) Continuance (amended.)
Brazil—Further Correspondence.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, March 13th*, 1863.]

Dated 10th December, 1862.

3315. W. Clark, 53, Chancery-lane—Imp. in umbrellas. (A com.)

Dated 26th December, 1862.

3354. J. Farley, Bolton-le-Moors, Lancashire, and J. Crowther, Bradford, Yorkshire—Certain imp. in steam engines and apparatus connected therewith.

Dated 9th February, 1863.

356. J. Macintosh, North Bank, Regent's-park—Imp. in obtaining and applying motive power.

Dated 14th February, 1863.

411. F. E. Walker, James's-terrace, Waterloo-road—Imp. in the construction of breech-loading fire-arms.

Dated 20th February, 1863.

460. W. Marsden, 49, Old Bailey—Imp. in envelopes.

Dated 25th February, 1863.

528. T. V. Lee, 6, Bank-chambers, Lothbury—Imp. in machinery for digging, compressing, and moulding peat or turf, and for retorts and kilns for drying peat or turf, and making peat or turf charcoal through the agency of hydro-caloric or superheated steam, and for collecting the products of distillation whilst charring the peat or turf.
532. J. Inglis, Edinburgh—Imp. in machinery or apparatus for folding paper and other fabrics or materials.

INVENTIONS WITH COMPLETE SPECIFICATIONS FILED.

608. P. Adie, Strand—Imp. in means and apparatus for measuring angular and actual distances.—4th March, 1863.
658. J. H. Johnson, 47, Lincoln's-inn-fields—Imp. in the treatment of certain fibrous vegetable substances with a view to the production of textile materials therefrom. (A com.)—9th March, 1863.

PATENTS SEALED.

[*From Gazette, March 13th*, 1863.]

March 11th.
2532. E. Balmforth.
2534. H. M. Radloff.
2535. J. Webster.
2542. W. Clark.
2543. R. Moreland, jun.
2549. R. Cranston.
2574. J. Imray.
2576. C. Chinnock.
2577. G. Maw.
2601. J. Forran.
2653. J. L. Hughes.
2691. W. Taylor and S. Buckley.
2694. J. Bradbury and W. Bradbury.
2997. A. V. Newton.
3240. H. Wilde.
3276. J. Burchall & E. Borrows.
128. W. Hulse & C. L. Haines.

March 13th.
2533. W. L. Tizard.
2540. G. L. Lee.
2547. L. Leigh.
2553. J. Douglas.
2560. W. H. Browne and H. Armstrong.
2570. D. C. Bridge and J. Dyson.
2575. R. R. Jackson & J. Coupe.
2581. B. Hotchkiss.
2613. T. Kennedy.
3257. J. Biggs, J. Johnson, T. Richardson & T. Arnold.

[*From Gazette, March 17th*, 1863.]

March 17th.
2571. J. B. Giertz.
2583. J. Wilson.
2584. A. Prince.
2588. J. Long.
2590. M. Vogl.
5596. J. J. N. Micas.
2607. R. R. Jackson and Æ. I. Jackson.
2626. E. Dixon.
2672. W. Clark.
2713. A. V. Newton.
2726. J. H. Johnson.
2749. A. V. Newton.
2753. G. Haseltine.
2767. C. Harratt.
2880. T. G. Ghislin.
3164. G. Ranson.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

[*From Gazette, March 17th*, 1863.]

March 9th.
638. J. Lister and J. Lees.
656. M. J. E. Jullienne.

March 11th.
732. T. Sykes, B. C. Sykes, and J. W. Crossley.

March 12th.
719. J. H. Heal.

March 13th.
675. M. Henry.
679. J. H. Johnson.
680. I. Horton and I. Kendrick.
702. W. Wood.
707. E. Cope, W. Cope, and W. G. Ward.
773. J. H. Johnson.

March 14th.
697. W. Hudson and C. Catlow.
703. T. Richardson.
717. W. Clark.
734. W. Spence.

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

[*From Gazette, March 17th*, 1863.]

March 11th.
612. T. Porter.
635. C. B. Normand.

March 12th.
631. C. Randolph and J. Elder.

March 13th.
625. E. T. Wri ht.
1984. W. H. Perkin.

March 14th.
622. C. Coates.

LIST OF DESIGNS OF UTILITY REGISTERED.

No. in the Register.	Date of Registration.	Title.	Proprietor's Name.	Address.
4543	March 12.	Improved Fire Escape	George Clarke	Marchmont-street, London.
4544	„ 16.	Improved Grindstone Spindle, with adjustable Flanges	Walter Henry Phillips	Birmingham.
4545	„ 17.	Casing for Fire-places	Stephen Proctor	Elsecar, near Rotherham, Yorks.